National Institute of Environmental Health Sciences

The human health effects of ozone depletion and interactions with climate change

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Abstract:

Depletion of the stratospheric ozone layer has led to increased solar UV-B radiation (280-315 nm) at the surface of the Earth. This change is likely to have had an impact on human exposure to UV-B radiation with consequential detrimental and beneficial effects on health, although behavioural changes in society over the past 60 years or so with regard to sun exposure are of considerable importance. The present report concentrates on information published since our previous report in 2007. The adverse effects of UV radiation are primarily on the eye and the skin. While solar UV radiation is a recognised risk factor for some types of cataract and for pterygium, the evidence is less strong, although increasing, for ocular melanoma, and is equivocal at present for age-related macular degeneration. For the skin, the most common harmful outcome is skin cancer, including melanoma and the non-melanoma skin cancers, basal cell carcinoma and squamous cell carcinoma. The incidence of all three of these tumours has risen significantly over the past five decades, particularly in people with fair skin, and is projected to continue to increase, thus posing a significant world-wide health burden. Overexposure to the sun is the major identified environmental risk factor in skin cancer, in association with various genetic risk factors and immune effects. Suppression of some aspects of immunity follows exposure to UV radiation and the consequences of this modulation for the immune control of infectious diseases, for vaccination and for tumours, are additional concerns. In a common sun allergy (polymorphic light eruption), there is an imbalance in the immune response to UV radiation, resulting in a sun-evoked rash. The major health benefit of exposure to solar UV-B radiation is the production of vitamin D. Vitamin D plays a crucial role in bone metabolism and is also implicated in protection against a wide range of diseases. Although there is some evidence supporting protective effects for a range of internal cancers, this is not yet conclusive, but strongest for colorectal cancer, at present. A role for vitamin D in protection against several autoimmune diseases has been studied, with the most convincing results to date for multiple sclerosis. Vitamin D is starting to be assessed for its protective properties against several infectious and coronary diseases. Current methods for protecting the eye and the skin from the adverse effects of solar UV radiation are evaluated, including seeking shade, wearing protective clothing and sunglasses, and using sunscreens. Newer possibilities are considered such as creams that repair UV-induced DNA damage, and substances applied topically to the skin or eaten in the diet that protect against some of the detrimental effects of sun exposure. It is difficult to provide easily understandable public health messages regarding "safe" sun exposure, so that the positive effects of vitamin D production are balanced against the negative effects of excessive exposure. The international response to ozone depletion has included the development and deployment of replacement technologies

and chemicals. To date, limited evidence suggests that substitutes for the ozone-depleting substances do not have significant effects on human health. In addition to stratospheric ozone depletion, climate change is predicted to affect human health, and potential interactions between these two parameters are considered. These include altering the risk of developing skin tumours, infectious diseases and various skin diseases, in addition to altering the efficiency by which pathogenic microorganisms are inactivated in the environment.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Solar Radiation, Other Exposure

Other Exposure: ozone depletion

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Co-Benefit/Co–Harm (Adaption/Mitigation):

specification of beneficial or harmful impacts to health resulting from efforts to reduce or cope with greenhouse gases

A focus of content

Health Impact:

specification of health effect or disease related to climate change exposure

Cancer, Dermatological Effect, Other Health Impact

Other Health Impact: cataract;pterygium;pinguecula (conjunctival degeneration) and squamous cell carcinoma of the cornea and conjunctiva;photokeratitis;photoconjunctibitis;ocular melanoma;macular degeneration;UV-induced immunosupression

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation, Mitigation

Resource Type:

format or standard characteristic of resource

Review

Resilience:

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

A focus of content

Timescale:

time period studied

Time Scale Unspecified